

## CLAIMS

What is claimed:

1. A method for collecting computed tomography (CT) image data,  
comprising:

5 determining a number of intervals  $N$  into which a respiratory cycle is to be  
divided;

determining a number of respiratory cycles  $M$  to be covered in one gantry  
rotation; and

10 rotating a gantry to collect at least  $M \times N$  sets of CT image data of at least  
a portion of a patient, wherein each set of the CT image data corresponds to a  
phase of a respiratory cycle.

2. The method of claim 1, further comprising repeating the step of rotating  
until the number of gantry rotation is at least  $N$ .

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3. The method of claim 2, wherein the repeating comprises rotating the  
gantry at a phase that is offset from that of the previous gantry rotation.

4. The method of claim 3, wherein the offset phase is  $360^\circ/(M \times N)$  or less.

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5. The method of claim 3, wherein the offset phase is  $180^\circ/(M \times N)$  or less.

6. The method of claim 1, wherein the rotating comprises causing the gantry to rotate at a constant speed.

7. The method of claim 1, wherein the rotating comprises causing the gantry  
5 to rotate at a variable speed.

8. The method of claim 1, further comprising determining a breathing phase of the patient.

10 9. The method of claim 8, wherein the rotating comprises causing the gantry to rotate at a speed based on the breathing phase of the patient.

10. The method of claim 8, further comprising adjusting the speed of the gantry rotation based on the determined breathing phase of the patient.

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11. The method of claim 10, wherein the adjusting comprises changing the speed of the gantry rotation by a prescribed amount until a gantry phase matches with a corresponding breathing phase of the patient.

20 12. The method of claim 10, further comprising determining a difference between a gantry phase and the determined breathing phase, wherein the

adjusting comprises changing the speed of the gantry rotation in response to the difference.

13. The method of claim 10, further comprising:

5       estimating a next breathing phase of the patient based on the determined phase of the patient; and

          wherein the adjusting comprises changing the speed of the gantry rotation based on the estimated next breathing phase.

10   14. The method of claim 1, further comprising generating motion data associated with a breathing of the patient.

15   15. The method of claim 14, further comprising synchronizing the collected CT image data and the motion data to a common time base.

16. The method of claim 1, further comprising sorting the collected CT image data such that CT image data that correspond to a same phase of a respiratory cycle are grouped for CT image reconstruction.

20   17. A computer readable medium having a set of stored instructions, the execution of which causes a process to be performed, the process comprising:

determining a number of intervals  $N$  into which a respiratory cycle is to be divided;

determining a number of respiratory cycles  $M$  to be covered in one gantry rotation; and

5 rotating a gantry to collect at least  $M \times N$  sets of CT image data of at least a portion of a patient, wherein each set of the CT image data corresponds to a phase of a respiratory cycle.

18. The computer readable medium of claim 17, wherein the process further  
10 comprises repeating the step of rotating until the number of gantry rotation is at least  $N$ .

19. The computer readable medium of claim 18, wherein the repeating  
15 comprises rotating the gantry at a phase that is offset from that of the previous gantry rotation.

20. The computer readable medium of claim 19, wherein the offset phase is  $360^\circ/(M \times N)$  or less.

20 21. The computer readable medium of claim 19, wherein the offset phase is  $180^\circ/(M \times N)$  or less.

22. The computer readable medium of claim 17, wherein the rotating comprises causing the gantry to rotate at a constant speed.

23. The computer readable medium of claim 17, wherein the rotating  
5 comprises causing the gantry to rotate at a variable speed.

24. The computer readable medium of claim 17, wherein the process further comprising determining a breathing phase of the patient.

10 25. The computer readable medium of claim 24, wherein the rotating comprises causing the gantry to rotate at a speed based on the breathing phase of the patient.

26. The computer readable medium of claim 24, wherein the process further  
15 comprising adjusting the speed of the gantry rotation based on the determined breathing phase of the patient.

27. The computer readable medium of claim 26, wherein the adjusting  
comprises changing the speed of the gantry rotation by a prescribed amount until  
20 a gantry phase matches with a corresponding breathing phase of the patient.

28. The computer readable medium of claim 26, wherein the process further comprising determining a difference between a gantry phase and the determined breathing phase, wherein the adjusting comprises changing the speed of the gantry rotation in response to the difference.

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29. The computer readable medium of claim 26, wherein the process further comprising:

estimating a next breathing phase of the patient based on the determined phase of the patient; and

10 wherein the adjusting comprises changing the speed of the gantry rotation based on the estimated next breathing phase.

30. The computer readable medium of claim 17, wherein the process further comprising generating motion data associated with a breathing of the patient.

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31. The computer readable medium of claim 30, wherein the process further comprising synchronizing the collected CT image data and the motion data to a common time base.

20 32. The computer readable medium of claim 17, wherein the process further comprising sorting the collected CT image data such that CT image data that

correspond to a same phase of a respiratory cycle are grouped for CT image reconstruction.

33. A system for collecting computed tomography (CT) image data,

5 comprising:

means for determining a number of intervals  $N$  into which a respiratory cycle is to be divided;

means for determining a number of respiratory cycles  $M$  to be covered in one gantry rotation; and

10 means for rotating a gantry to collect at least  $M \times N$  sets of CT image data of at least a portion of a patient, wherein each set of the CT image data corresponds to a phase of a respiratory cycle.

34. The system of claim 33, wherein the means for rotating the gantry rotates  
15 the gantry at least  $N$  times.

35. The system of claim 34, wherein the means for rotating causes the gantry to rotate at a phase that is offset from that of the previous gantry rotation.

20 36. The system of claim 35, wherein the offset phase is  $360^\circ/(M \times N)$  or less.

37. The system of claim 35, wherein the offset phase is  $180^\circ/(M \times N)$  or less.

38. The system of claim 33, wherein the means for rotating causes the gantry to rotate at a constant speed.

5 39. The system of claim 33, wherein the means for rotating causes the gantry to rotate at a variable speed.

40. The system of claim 33, further comprising means for determining a breathing phase of the patient.

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41. The system of claim 40, wherein the means for rotating comprises causing the gantry to rotate at a speed based on the breathing phase of the patient.

42. The system of claim 40, further comprising means for adjusting the speed  
15 of the gantry rotation based on the determined breathing phase of the patient.

43. The system of claim 42, wherein the means for adjusting comprises means for changing the speed of the gantry rotation by a prescribed amount until a gantry phase matches with a corresponding breathing phase of the patient.

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44. The system of claim 42, further comprising means for determining a difference between a gantry phase and the determined breathing phase, wherein



the means for adjusting comprises means for changing the speed of the gantry rotation in response to the difference.

45. The system of claim 42, further comprising:

5 means for estimating a next breathing phase of the patient based on the determined phase of the patient; and

wherein the means for adjusting comprises means for changing the speed of the gantry rotation based on the estimated next breathing phase.

10 46. The system of claim 33, further comprising means for generating motion data associated with a breathing of the patient.

47. The system of claim 46, further comprising means for synchronizing the collected CT image data and the motion data to a common time base.

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48. The system of claim 33, further comprising means for sorting the collected CT image data such that CT image data that correspond to a same phase of a respiratory cycle are grouped for CT image reconstruction.

20 49. A method for generating a computed tomography (CT) image, comprising:  
collecting data samples representative of a physiological movement of a patient due to breathing;

determining a number of intervals  $N$  into which a breathing cycle of the patient is to be divided;

rotating a gantry at least  $N$  times to acquire image data of at least a part of the patient;

5 gathering image data acquired at a same phase of a breathing cycle; and  
generating a CT image using the gathered image data.

50. The method of claim 49, further comprising controlling a speed of the gantry based on the data samples.

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51. The method of claim 49, wherein the generating comprises constructing a volumetric image.

52. A computer readable medium having a set of stored instructions, the  
15 execution of which causes a process to be performed, the process comprising:  
collecting data samples representative of a physiological movement of a patient due to breathing;

determining a number of intervals  $N$  into which a breathing cycle of the patient is to be divided;

20 rotating a gantry at least  $N$  times to acquire image data of at least a part of the patient;

gathering image data acquired at a same phase of a breathing cycle; and

generating a CT image using the gathered image data.

53. The computer readable medium of claim 52, wherein the process further comprising controlling a speed of the gantry based on the data samples.

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54. The computer readable medium of claim 52, wherein the generating comprises constructing a volumetric image.

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